

label prescribed in § 172.450 of this subchapter is affixed to the packaging; and

(e) The packaging is prepared for shipment as specified in § 173.422.

[Amdt. 173-244, 60 FR 50307, Sept. 28, 1995, as amended by Amdt. 173-244, 61 FR 20752, May 8, 1996]

**§ 173.431 Activity limits for Type A and Type B packages.**

(a) Except for LSA material and SCO, a Type A package may not contain a quantity of Class 7 (radioactive) materials greater than  $A_1$  for special form Class 7 (radioactive) material or  $A_2$  for normal form Class 7 (radioactive) material as listed in § 173.435, or, for Class 7 (radioactive) materials not listed in § 173.435, as determined in accordance with § 173.433.

(b) The limits on activity contained in a Type B, Type B(U), or Type B(M) package are those prescribed in §§ 173.416 and 173.417, or in the applicable approval certificate under §§ 173.471, 173.472 or 173.473.

**§ 173.433 Requirements for determining  $A_1$  and  $A_2$  values for radionuclides and for the listing of radionuclides on shipping papers and labels.**

(a) Values of  $A_1$  and  $A_2$  for individual radionuclides that are the basis for many activity limits elsewhere in this subchapter are given in the table in § 173.435.

(b) For individual radionuclides whose identities are known, but which are not listed in the table in § 173.435, the determination of the values of  $A_1$  and  $A_2$  requires approval from the Associate Administrator for Hazardous Materials Safety except that the values of  $A_1$  and  $A_2$  in Table 10 may be used without obtaining approval from Associate Administrator for Hazardous Materials Safety.

(c) In calculating  $A_1$  and  $A_2$  values for a radionuclide not listed in the table in § 173.435, a single radioactive decay chain in which the radionuclides are present in their naturally-occurring proportions, and in which no daughter nuclide has a half life either longer than 10 days or longer than that of the parent nuclide, will be considered as a single radionuclide, and the activity to be taken into account and the  $A_1$  or  $A_2$

value to be applied will be those corresponding to the parent nuclide of that chain. Otherwise, the parent and daughter nuclides will be considered as a mixture of different nuclides.

(d) Mixtures of radionuclides whose identities and respective activities are known, must conform to the following conditions:

(1) For special form Class 7 (radioactive) material:

$$\sum_i \frac{B(i)}{A_1(i)} \quad \text{less than or equal to } 1$$

Where  $B(i)$  is the activity of radionuclide  $i$  and  $A_1(i)$  is the  $A_1$  value for radionuclide  $i$ ; or

(2) For other forms of Class 7 (radioactive) material, either—

$$\sum_i \frac{B(i)}{A_2(i)} \quad \text{less than or equal to } 1$$

Where  $B(i)$  is the activity of radionuclide  $i$  and  $A_2(i)$  is the  $A_2$  value for radionuclide  $i$ ; or

$$A_2 \text{ for mixture} = \frac{1}{\sum_i \frac{f(i)}{A_2(i)}}$$

where  $f(i)$  is the fraction of activity of nuclide  $i$  in the mixture and  $A_2(i)$  is the appropriate  $A_2$  value for nuclide  $i$ .

(e) When the identity of each nuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest  $A_1$  or  $A_2$  value, as appropriate, for the radionuclides in each group may be used in applying the formulas in paragraph (d) of this section. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest  $A_1$  or  $A_2$  values for the alpha emitters or beta/gamma emitters, respectively.

(f) *Shipping papers and labeling.* (1) For mixtures of radionuclides, the radionuclides ( $n$ ) that must be shown on shipping papers and labels in accordance with §§ 172.203 and 172.403 of this subchapter, respectively, must be